Computer-Based Released Items
High School Biology MCAS
Spring 2023

The spring 2023 High School Biology test was administered in two formats: a computer-based version and a paper-based version. Most students took the computer-based test. The paper-based test was offered as an accommodation for eligible students who were unable to use a computer.

The Department of Elementary and Secondary Education is releasing items from both versions of the test to provide information about the knowledge and skills that students are expected to demonstrate.

- Released items from the **computer-based test** are available online at mcas.pearsonsupport.com/released-items. The computer-based released items are collected in a "mini test" called an ePAT (electronic practice assessment tool). Items in the ePAT are displayed in TestNav 8, the testing platform for the computer-based tests.

- Released items from the **paper-based test** are available in PDF format on the Department's website at www.doe.mass.edu/mcas/release.html.

This document provides information about each released item from the *computer-based test*, including the following: reporting category, standard covered, science practice category covered (if any), item type, and item description. Answers are provided for selected-response items only. Sample student responses and scoring guides for constructed-response items will be posted at www.doe.mass.edu/mcas/student/.

A Note about Testing Mode

Most of the operational items on the Biology test were the same, regardless of whether a student took the computer-based version or the paper-based version. In places where a technology-enhanced item was used on the computer-based test, an adapted version of the item was created for use on the paper test. These adapted paper items were multiple-choice or multiple-select items that tested the same STE content and assessed the same standard as the technology-enhanced item.

High School Biology
Spring 2023 Computer-Based Released Operational Items

CBT Item No.	Reporting Category	Standard	Science Practice Category	Item Type*	Item Description	Correct Answer (SR)**
1	Ecology	HS.LS.2.6	C. Evidence, Reasoning, and Modeling	SR	Describe how an environmental change would most likely affect the survival of a species.	B
2	Heredity	HS.LS.3.3	B. Mathematics and Data	SR	Determine the percentage of offspring from a given cross that would be expected to inherit a particular trait.	A
3	Heredity	HS.LS.3.2	C. Evidence, Reasoning, and Modeling	SR	Interpret a model of crossing over and describe how crossing over increases genetic variation.	C
4	Evolution	HS.LS.4.4	None	SR	Describe how bacterial reproduction and survival can result in an antibiotic becoming less effective over time.	A
5	Heredity	HS.LS.3.4	None	SR	Identify an example of polygenic inheritance.	B
6	Molecules to Organisms	HS.LS.1.7	C. Evidence, Reasoning, and Modeling	SR 2 pt.	Describe how a step in a model can be improved to more accurately describe how usable energy is produced by an athlete and identify a product of cellular respiration.	Part A: C Part B: *see page 5*
7	Heredity	HS.LS.3.1	None	SR	Use evidence about the number of chromosomes in gametes and body cells to support a claim.	A
8	Ecology	HS.LS.2.7	A. Investigations and Questioning	SR	Analyze the setup of an experiment to determine the purpose of the investigation about invasive species.	C
9	Ecology	HS.LS.2.2	C. Evidence, Reasoning, and Modeling	SR	Analyze a food web to determine how an increase in one population would affect another population.	B
10	Molecules to Organisms	HS.LS.1.6	None	SR	Identify which element is most abundant in a protein.	B
11	Evolution	HS.LS.4.5	C. Evidence, Reasoning, and Modeling	SR	Explain why closely related organisms may not produce fertile offspring in the wild.	D
12	Molecules to Organisms	HS.LS.1.2	None	SR	Describe how an inherited mutation most likely affects the functioning of the digestive system.	C
13	Heredity	HS.LS.3.2	None	SR	Identify the type of cell that can pass a mutation from parent to offspring.	*see page 5*
14	Molecules to Organisms	HS.LS.1.2	None	SR	Describe how an inherited mutation can affect the functioning of the respiratory system.	C
15	Molecules to Organisms	HS.LS.1.1	C. Evidence, Reasoning, and Modeling	SR 2 pt.	Determine the mRNA sequence for a given DNA sequence and determine the missing amino acid of a protein produced as a result of a mutation.	C;B

16	Heredity	HS.LS.3.3	C. Evidence, Reasoning, and Modeling	CR 3 pt.	Analyze a pedigree to determine the inheritance pattern for a condition, complete a Punnett square for a given cross, determine the probability of inheriting the condition, and explain how the probability was determined.	
17	Ecology	HS.LS.2.5	B. Mathematics and Data	SR	Analyze a graph to compare the rates of photosynthesis and cellular respiration in an aquatic ecosystem.	*see page 5*
18	Evolution	HS.LS.4.1	C. Evidence, Reasoning, and Modeling	SR	Complete a cladogram showing the relatedness between species based on DNA evidence.	*see page 5*
19	Ecology	HS.LS.2.5	C. Evidence, Reasoning, and Modeling	SR	Determine two changes that would improve a carbon cycle model.	A,C
20	Molecules to Organisms	HS.LS.1.4	None	CR 4 pt.	Describe events of interphase, explain why mitosis must occur before cytokinesis, and explain the effect on the human body if a person's cells stopped going through mitosis and cytokinesis.	
21	Evolution	HS.LS.4.2	C. Evidence, Reasoning, and Modeling	CR 4 pt.	Determine a genotype for a trait based on an inheritance pattern, describe the expected allele frequencies in a population, and explain how changes in allele frequencies can be a result of natural selection.	
22	Ecology	HS.LS.2.2	None	SR	Determine the type of symbiotic relationship between two species.	A
23	Ecology	HS.LS.2.2	None	SR	Identify changes that would result in an increase in the size of a population.	C
24	Molecules to Organisms	HS.LS.1.1	None	SR	Determine the cell part most responsible for protein synthesis.	D
25	Heredity	HS.LS.3.4	C. Evidence, Reasoning, and Modeling	SR 2 pt.	Identify whether a characteristic of an animal is most directly caused by genetic factors or environmental factors, and determine whether the animal's phenotype and genotype change or stay the same.	*see page 6*
26	Heredity	HS.LS.3.2	C. Evidence, Reasoning, and Modeling	SR	Determine how a particular mutation would be expected to affect the function of the resulting protein.	A
27	Evolution	HS.LS.4.5	None	SR	Identify an example of speciation due to geographic isolation.	D
28	Heredity	HS.LS.3.3	B. Mathematics and Data	SR	Determine the expected percentage of offspring with a certain phenotype for a given cross.	A
29	Molecules to Organisms	HS.LS.1.2	None	SR	Describe the interaction between the liver and the circulatory system.	D
30	Ecology	HS.LS.2.7	None	SR	Describe the impact of an invasive plant species in an ecosystem.	C
31	Ecology	HS.LS.2.1	None	SR	Identify an environmental change that would most likely increase the carrying capacity for a given population.	D

32	Heredity	HS.LS.3.1	C. Evidence, Reasoning, and Modeling	SR	Use a model to show the process of meiosis and fertilization.	D
33	Evolution	HS.LS.4.1	None	SR	Determine the type of evidence that best supports a claim about the relatedness of two species.	C
34	Evolution	HS.LS.4.2	C. Evidence, Reasoning, and Modeling	SR	Explain why one species may be better able to survive a disease outbreak than another species.	B
35	Molecules to Organisms	HS.LS.1.7	None	SR	Identify the process that produces energy for cell growth.	*see page 6*
36	Molecules to Organisms	HS.LS.1.3	C. Evidence, Reasoning, and Modeling	SR 2 pt.	Determine whether substances would be expected to move into or out of cells based on their concentration gradients, and describe how cell membranes help to maintain homeostasis.	Part A: *see page 6* Part B: C
37	Ecology	HS.LS.2.4	C. Evidence, Reasoning, and Modeling	CR 3 pt.	Identify the ecological role of an organism in an ecosystem, analyze a food web to determine how an increase in one population would affect another population, and explain why producers have the most available energy in an ecosystem.	
38	Heredity	HS.LS.3.1	None	SR	Explain why a human infant is genetically similar to, but not identical to, its mother.	D
39	Molecules to Organisms	HS.LS.1.6	None	SR	Identify the monomers that make up an organic macromolecule.	A
40	Heredity	HS.LS.3.3	A. Investigations and Questioning	SR	Analyze phenotypic data for several genetic crosses to determine the cross that would produce the most heterozygous offspring.	D
41	Evolution	HS.LS.4.4	C. Evidence, Reasoning, and Modeling	SR 2 pt.	Determine the cause of the rapid spread of a virus and explain how new types of viruses can develop.	D;A
42	Molecules to Organisms	HS.LS.1.5	B. Mathematics and Data	CR 4 pt.	Determine that photosynthesis is a process performed only by plants and that cellular respiration is a process performed by both plants and animals; analyze data to determine whether flasks in an experiment contain plants, animals, or both and explain the reasoning.	

* STE item types are selected-response (SR) and constructed-response (CR). All selected-response items are worth 1 point unless otherwise noted.

**Answers are provided here for selected-response items only. Pages 5 and 6 of this document provide correct answers for technology-enhanced (TE) items. Sample student responses and scoring guides for constructed-response items will be posted at www.doe.mass.edu/mcas/student/.

Correct Answer for CBT Item #6 Part B: Technology-Enhanced Item

As the athlete runs, the amount of [carbon dioxide] produced by the body increases.

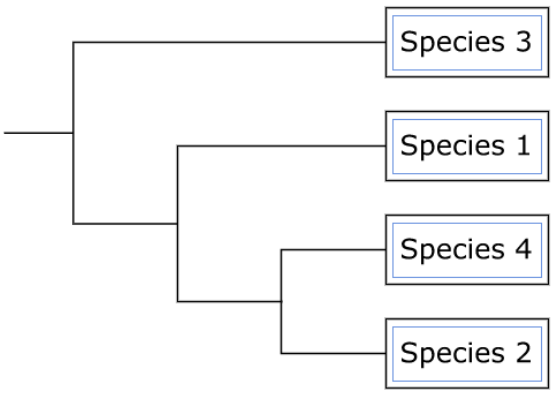
Correct Answer for CBT Item #13: Technology-Enhanced Item

For the person labeled 8 to have inherited the condition, the CFTR mutation must have been in the parents' [sex] cells.

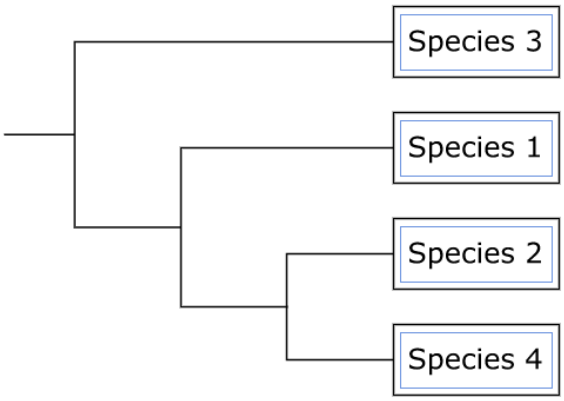
Correct Answer for CBT Item #17: Technology-Enhanced Item

Between 6 a.m. and 6 p.m., the rate of [photosynthesis] is greater than the rate of [cellular respiration.]

Correct Answers for CBT Item #18: Technology-Enhanced Item



or



Correct Answer for CBT Item #25: Technology-Enhanced Item

Part A:

Feather Color	Genetic Factors	Environmental Factors
white and gray in young flamingos	◉	○
pink in adult flamingos	○	◉

Part B:

The pink color of flamingo feathers demonstrates that the phenotype for feather color [changes,] but the genotype for feather color [stays the same.]

Correct Answer for CBT Item #35: Technology-Enhanced Item

The energy needed for cell growth in marbled crayfish is provided by the process of [cellular respiration.]

Correct Answer for CBT Item #36 Part A: Technology-Enhanced Item

Substance	Moves Into Cell	Moves Out of Cell
sodium	○	◉
water	◉	○